

## An Analytic Formulation of Ejecta Distributions over Airless Bodies

Mark Matney

With recent plans to revisit the Moon by robotic and crewed spacecraft, there has been a renewed interest in understanding the ejecta environment on the Moon and other airless bodies. Meteoroid and asteroid impacts can excavate large amounts of material from the surface and, above an airless body, can send this material long distances on (essentially) ballistic orbits. This ejecta, while typically traveling slower than the impactor, can nevertheless achieve high enough speeds to endanger surface operations. Accurate knowledge of this phenomenon is necessary in order to design appropriate shielding for human activities, both for activities on the surface of the Moon and for orbiters in near-lunar space. This phenomenon is also important in the transport of particles above other Solar System objects, such as Jovian satellites, where this ejecta creates a kind of ever-present “halo” of particles around the gravitating body. While Monte Carlo techniques have been successfully used to model this environment, there are useful analytic expressions, developed for use in modeling the meteoroid environment, that can be used to describe this environment as well. Such analytic tools can shed light on the altitude, velocity, and directionality of these ejecta environments.